



# Situation Awareness and Decision Making in a Warning Environment

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Advanced Warning Operations Course  
IC Core 2

Lesson 3: Team SA



Warning Decision Training Branch

Lesson 3 will focus on the Situation Awareness (SA) of teams. The “teams” in this lesson are not limited to the forecast office staff. For example, another team would be the entire group comprised by the forecast office, the media, and emergency managers, who are all part of the warning effort.

## Lesson 3: Team SA

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Learning Objective:

- Identify factors that can impact getting and maintaining team SA.

“When in danger, when in doubt, run in circles,  
scream and shout”

John Helpling

The Learning Objective for Lesson 3 applies to factors that affect getting and maintaining team SA. The Learning Objectives will be tested when you take the on-line exam for IC Core 2.

## Lesson 3: Team SA

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### Performance Objectives

1. Using specific data examples, identify the three levels of SA and how they are contributing to your warning decisions, while working:
  - a) WES simulations, and
  - b) Warning events.
2. As part of post-event analysis, determine the role that SA (good or bad) at the three levels played in the warning decisions that were made.

The Performance Objectives for Lesson 3 apply during this course as well as after completion. Though they are not tested formally, questions related to these Performance Objectives will be posed during the course simulations. Developing SA in the “domain” of the warning environment is a skill that evolves over time and is an important asset in making sound warning decisions.

## **Team SA**

### **A Shared Understanding**



This photo was taken at a forecast office during a significant warning event. There are eight people working in this one area and others working elsewhere. The potential for communications chaos is very high and there are a number of important questions to consider about managing this environment.

# Apollo 13 and Team SA



The Apollo 13 mission is an interesting example of a shift in team SA. This large team of controllers had to build their SA sufficiently to shift the goal from mission completion to getting the astronauts back alive. Imagine the reluctance to abandon the mission, but lengthy resistance would have caused delays that might have prevented the return of the astronauts.

# Flight 1549: Landing on the Hudson River

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- This team had a clearly defined leader
  - some teams don't
- Sully had to “goal sacrifice”, shifting
  - from saving the plane + passengers
  - to saving just the passengers
- Crew members shifted with him and knew what to do



Time: Year in Pictures 2009 / Steven Day / AP

A recent example of a significant shift in team SA is the successful landing of Flight 1549 on the Hudson river in January of 2009. Captain Sully had to sacrifice the goal of saving both the plane and passengers in order to change his goal to simply save the passengers. Once that shift occurred, the crew shifted with him and knew what to do.

# Are Team Decisions Inherently Better?

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- **Nope**
- Differing views can paralyze a team
- Teams may have collective errors
- Communication among team members may be faulty
- Status and cultural differences may have impacts

Team SA has its own challenges. Team decisions are not necessarily better. There are a number of things that can derail team SA, such as inability to resolve conflicts, poor communication, status and cultural differences.

# Team SA Definition

“The active construction of a situation partly shared and partly distributed between two or more agents, from which one can anticipate important states in the near future.” Salas et al 1995

- Team SA is the result of each individual's SA
- If one individual loses SA, it can affect that of the group

“40% of reported incidents in the ASRS data base occurred when **only one** crew member had a problem with SA.”

<http://asrs.arc.nasa.gov>

The definition of team SA addresses the construction of SA for each individual, with information shared among team members, building team SA. The quote from ASRS shows that the impact is significant when only one member of a team loses their SA. ASRS is the Aviation Safety Reporting System, a web site provided by NASA where pilots and crew members can report incidents anonymously. This database is also used by human factors researchers.

# Loss of Team SA NWS Example

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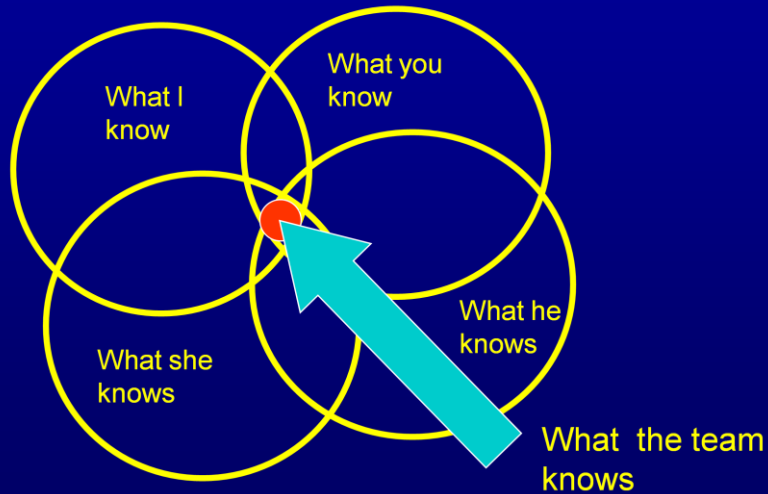
- Unwarned flash flood
  - Each individual had some awareness of heavy rain and/or flood potential
    - Each person knew about one piece of the threat
  - Nobody investigated
    - Nobody assigned to monitor for flash flooding
    - Duties among staff not well communicated
    - No one seeking ground truth



AWOC Core 3 RCA

Here's a case of an unwarned flash flood. Each of the individuals had some knowledge, but it was not communicated. One person had been monitoring for flash flooding earlier, changed to another task, but did not delegate to someone else. Members of the team noted the heavy rain at different times, but nothing further was done. Most importantly, no one was formally assigned the task.

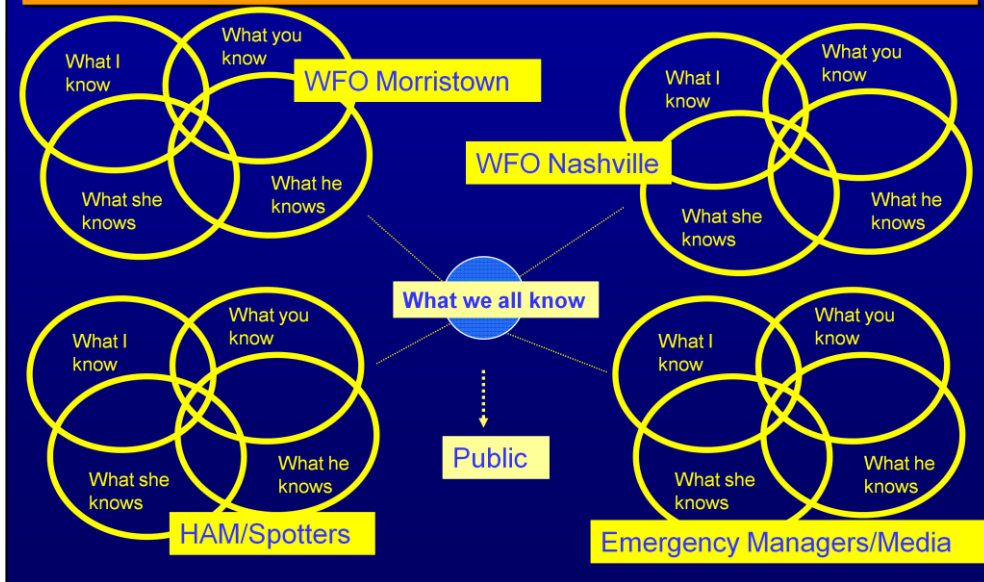
# Team SA



The subset of information that all team members need to know can be quite small. Each team member will likely have a vast amount of individual knowledge, but only a portion of it needs to be shared. In the previous example, just keeping track of who is monitoring for flash flooding may have been sufficient for “what the team knows” and might have been enough for a warning.

# Team SA

## Distributed Teams



The warning process involves many teams, both internal and external to the NWS office. In addition to the NWS offices, HAMs/spotters, Emergency Managers, and the media are all members of the distributed team involved in the warning process. The better the communications among these groups, as well as a clear understanding of roles and responsibilities, the better the chance for good decision making and public service during severe weather events.

# Distributed Teams and NWSChat

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- Improves flow of information to/from FOs and core partners
  - Media/EMs have faster and easier access to FO products
- Tool for FOs to monitor upstream impacts
- Potential to build relationships and trust
  - Enhance the shared goals of the NWS and its core partners



NWSChat has a unique role in the distributed teams of the warning process. It improves the flow of information between the NWS and its core partners. It allows FOs to monitor upstream impacts. Most importantly, it has the potential to build relationships and trust. The goals of the NWS and its core partners are ultimately the same, and NWSChat supports the sharing of these goals.

## Distributed Teams – SA Shift NWS Example

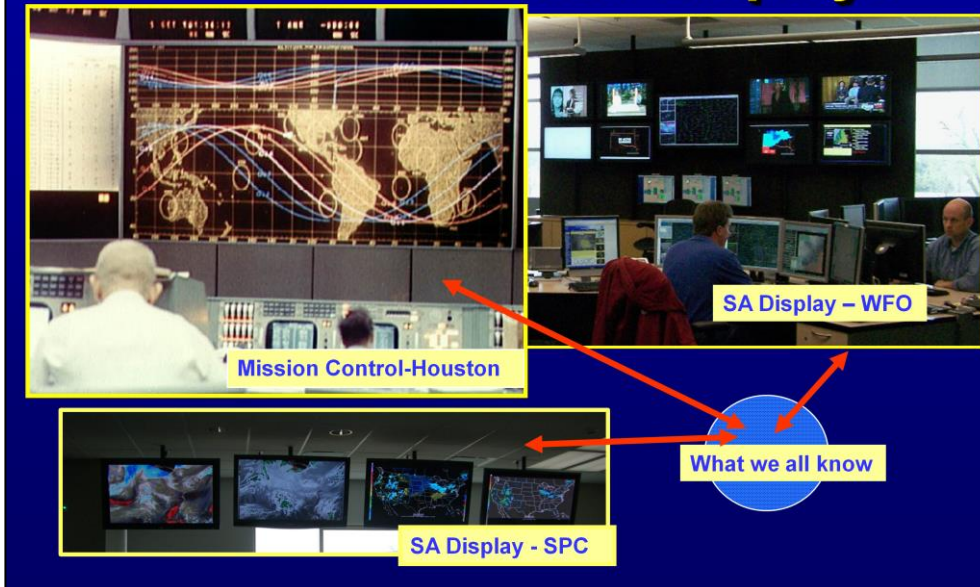
- PDS Tornado watch; spotters looking for tornadoes
- Radar shows intense non-tornadic supercells
  - SVR warnings, no TORs
- One spotter reports “debris” at distance
  - Actually large hail
- NWS message to spotters through amateur radio
  - Not seeing tornado potential on radar
- Spotters shift SA and hail reports increase



In this example, the fact that a PDS Tornado Watch had been issued had shifted the SA of the spotters toward rotation and tornadoes. Radar was indicating intense supercells, but rotation signatures on radar were minimal. No tornado warnings were issued, only severe thunderstorm. The forecast office was expecting hail reports and not getting them until a spotter reported “debris” at a distance. The NWS used amateur radio to communicate to the spotters that the tornado potential was low at that time and that hail seemed to be the threat. Not long after, hail reports began coming in as the spotters shifted their SA.

# **“What We All Know”**

## **The Use of Situation Displays**



SA displays have been used in other domains for many years and new technologies support more robust designs. Mission Control in Houston may be the best known example of a large SA display. Many forecast offices have SA displays to support warning operations.

# Team SA and Leadership

- Impacts of Good Leadership
  - *Roles and responsibilities are well defined, understood and respected*
  - Promote familiarity among staff
    - Encourage good communications
  - Minimize “face threat”
    - Perceived penalty for calling attention to someone’s error
    - ***Face threat can prevent the transfer of critical information***



Leadership can strongly affect team SA and performance...favorably or unfavorably! Leadership is most important in creating an environment where roles and responsibilities are well defined, understood and the role of each individual is valued and respected. Leadership sets the tone for communications among staff members. Good leadership can also minimize “face threat”, which is a sometimes dangerous hindrance to communication. At all times, the most junior member of the staff should feel comfortable pointing out potential errors to the most senior member of the staff. If not, there’s a chance that critical information may not be communicated.

# Team SA and Leadership

- Leadership and Face Threat
  - In aviation, face threat often cited in failures of first officers in monitoring/challenging the captain's decisions



“Face Threat” inhibits communication, sometimes tragically. Self-awareness on the part of senior person is just as important as assertiveness on the part of the journeyman. Good leadership provides an environment where communication between superiors and subordinates flows freely.

# Team SA and Leadership

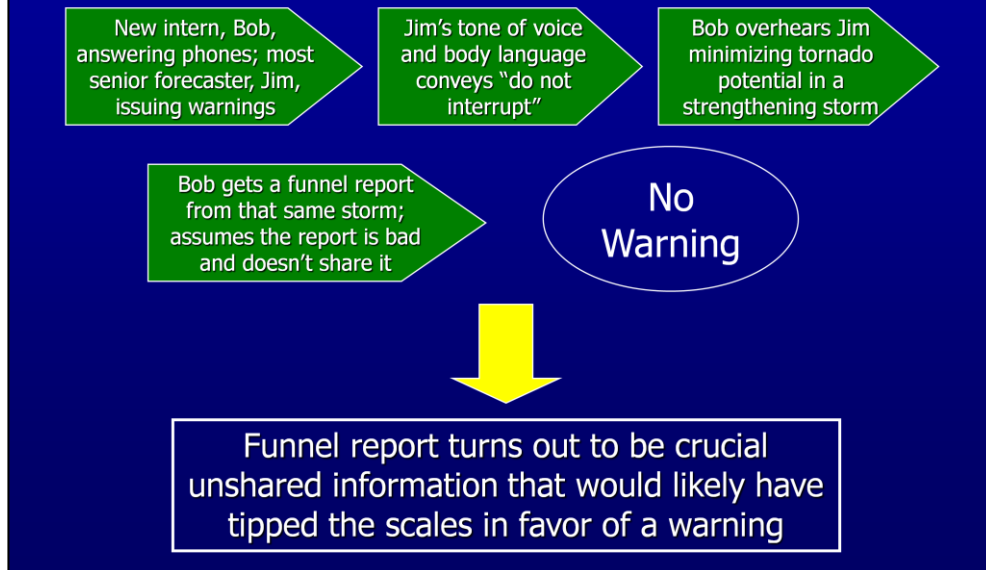
- Flight 1549: clear leadership, no face threat
  - “My aircraft”
    - Sully takes control; co-pilot Jeff knows what to do
      - “Jeff seemed to be equally on task.” “Without me asking, he began to call out to me the altitude above the surface and the airspeed. It was awful and beautiful at the same time.”
  - “This is the captain. Brace for impact”
    - Flight Attendants know what to do
      - “I knew that if I could deliver the aircraft to the surface intact...their direction and professionalism would be keys to our survival, and I had faith in them.”



Time: Year in Pictures 2009 / Steven Day / AP

The successful landing and evacuation of Flight 1549 was achieved due to the leadership of Captain Sully, which included his ability to communicate only what was needed to the crew. He also had confidence in their ability to do what they had been trained to do. His verbal and non-verbal communication conveyed that confidence.

# Impact of Face Threat on Warning Operations



This situation is based on a real event. “Bob” is the new intern, answering the phones. “Jim” is the lead forecaster, but his verbal and non-verbal messages deliver the message that he doesn’t want to be bothered and that a strengthening storm isn’t likely to produce a tornado. When Bob gets a report of a funnel, he is reluctant to share it (can you blame him?) and decides it must be invalid. The result is an unwarned tornado.

# Leadership

## ***Not Limited to Management***

- Leadership is more about ***contributing*** to the team than ***directing*** the team
  - ***Everyone*** has the potential to contribute leadership
  - Teams do ***not*** need rigid hierarchy to perform well
  - ***Everyone*** can contribute to communications, planning and adaptability (coming up...)



When I use the term leadership, I do mean something that is limited to management. It is about contributing to the team rather than directing the team and everyone has the potential to do that. A rigid hierarchy is not needed to allow a team to perform well, with each individual contributing to the communications, planning, etc.

# Team SA and Communications

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- Communications
  - *Roles and responsibilities are well defined, understood and respected*
  - Seek clarity, avoid assumptions, focus on **most relevant** content
  - Minimize “distracter” information
    - Flight 1549 descending very rapidly
    - Patrick (controller) ignored protocol
      - Did not ask basic questions
      - Asked Sully what he wanted instead of directing him



Even in the absence of face threat, communications can suffer. Once again, roles and responsibilities need to be well defined and understood by all. Assumptions need to be avoided, so ask questions as needed for clarity. Do not share irrelevant information, which will vary from event to event.

## **Lesson in Communications From an Experienced Pilot...**

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- Family vacation...turn my attention to my wife and the map in her lap...youngest son makes the call: "Daddy, the trees!" We're off the road...I spin the wheel to the left...we're back on the road. I'm a very humble man.
- Lesson 1: Each of us, regardless of time, experience, qualification, rank or position, can **still do stupid things**. Be humble.
- Lesson 2: A "fledgling" member of my crew makes the call. Listen to **everyone**. Look beyond age, experience, rank and qualifications.

J.S.T. Ragman

This example is a personal story from an experienced commercial pilot, Air Force Reserve Guard unit commander, and trainer. His message is to always be on guard for error and to always listen to everyone on your crew.

# FO Team SA

## Internal Communications

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- Gaps
  - Report of previous tornado sent to WFO, but not passed to warning forecaster
  - Call from EM...told storm was expected to weaken; call was not logged or discussed with others...storm intensified
- Connections
  - Warning coordinator, teams of warning forecasters, roles and responsibilities for each individual well defined and understood



Here are examples of internal communications within a forecast office, both good and bad. The gaps are examples of crucial pieces of information that were not passed to the right person...the warning forecaster needs to know in real time if a particular storm has previously produced a tornado. Another gap is one staff member telling an EM that a storm is expected to weaken and not sharing this conversation with the warning forecaster who was working that storm. An example of good connections is the presence of a warning coordinator and all staff members having clearly defined roles and responsibilities.

# FO Team SA

## External Communications

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- Gaps
  - Not enough staff to handle workload, SVSs and LSRs not issued
  - EM told storm expected to weaken, though it intensified; EM not contacted before warning issued for his county
- Connections
  - NWSChat provides direct communications between the NWS and its core partners



Here are examples of external communications, both good and bad, between the forecast office and the media and emergency managers (EMs). One of the gaps results from not having adequate staff for the event, resulting in no SVSs or LSRs being issued. These products provide a valuable service to the media and EMs, and hampered the performance of these external partners. In another case, an EM talked to a staff member and was told that a storm is expected to weaken. When the storm intensified and a warning was issued for that county, the EM was not notified in advance. Good external communications involve direct connections between the NWS and core partners. Use of strong language in warnings and statements helps to convey a particularly high threat.

# Team SA and Planning

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- Preparation, Planning

- *Roles and responsibilities are well defined, understood and respected*

- “predefined severe weather shift duties...allowed the staff to focus on specific duties with knowledge that all necessary tasks were being completed...minimized duplication of effort and maximized warning and communications performance.”

- Prepare yourself, be aware of yourself and others, have a plan



Pre-planning can make a significant difference during warning operations. Successful office performance often results from well defined responsibilities for each individual, as well as a coordinator to oversee workload and to deal with the inevitable surprises. The quote is from a service assessment of a widespread but successful event. Each staff member was better able to focus on their particular duties because they knew that all necessary operations were accounted for.

# Team SA and Adaptability

- Adaptability
  - If the plan isn't working, change the plan!
  - Strive for a pro-active mode, instead of reactive
  - Be mindful of the potential need to “goal sacrifice”



There is no single “plan” for severe weather operations. Since the warning environment is so dynamic, adaptability is essential. It may be necessary to call in more staff, adjust warning sectors, and adjust roles and responsibilities, as needed. Adaptability allows for a more proactive approach to warning operations, instead of reactive.

# Team SA and “Warning Coordinator”

- **Not** a “catch all” person for unassigned tasks
- Maintains “event level” SA
  - Oversees end-to-end office operations
  - Doesn’t know details such as storm scale structures
- Monitors staffing and workload
- Gages the office’s message to the customer
  - Flow of products
  - Wording of products
- Ensure actions are documented



The warning coordinator has to maintain his or her own SA, which is “event level”. The warning coordinator does not know details such as storm scale structures, which is the focus of the warning forecaster’s individual SA. The warning coordinator manages team SA by monitoring staffing and workload, as well as monitoring the office’s overall message to the customer.

## Team SA Summary

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- Team SA requires all to maintain individual SA and contribute to group SA
- Several **controllable** factors can impact the team's ability to have it and keep it
  - Roles and responsibilities defined, understood, and respected
  - Effective communications: No face threat!
  - Pro-active planning and adaptability
  - Having adequate staff available and managing workload supports all of the above!

In summary, team SA requires team members to maintain their individual SA and contribute to the group SA. There are several controllable factors, such as well defined roles and responsibilities, effective communications, planning, adaptability, and managing staff workload.

“It will not do to leave a live dragon out of  
your plans if you live near one.”

J.R.R. Tolkien



A final word from J.R.R. Tolkien. Since we have a live dragon living nearby,  
it's best to plan for it!

Which of the following statements is true concerning factors that contribute to attaining and maintaining team Situational Awareness (SA)?

- Effective teams operate with well-defined roles and responsibilities among team members.
- Team members have little to no input in an environment where everyone feels comfortable participating and sharing information.
- Individuals usually consider the approach to solving operations, rather than problem.
- Once an effective strategy is chosen another operations plan, it should not be discarded.

## AWOC Core, IC2, Lesson3 - Team SA

Quiz - 1 question

Last Modified: Apr 13, 2015 at 02:37 PM

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# Situation Awareness and Decision Making in a Warning Environment

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Advanced Warning Operations Course  
IC Core 2

Lesson 3: Team SA



Warning Decision Training Branch

This concludes Lesson 3: Team SA. There are two remaining lessons for AWOC Core 2.

# Questions?

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1. Check with your AWOC facilitator (most often the SOO)
2. Send your question to  
[awoccore\\_list@wdtb.noaa.gov](mailto:awoccore_list@wdtb.noaa.gov)

If you have questions about the material from AWOC Core 2, first check with your AWOC facilitator (most likely your SOO). If your AWOC facilitator cannot answer your question, please send an email to [awoccore\\_list@wdtb.noaa.gov](mailto:awoccore_list@wdtb.noaa.gov).